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Selected Chemical Analyses of Water from Lakes in Ellesmere Island National Park Reserve, Nunavut

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by

J.A. Babaluk, L.G. Heuring, J.D. Reist, and B.N. Billeck

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ABSTRACT

Babaluk, J.A., L.G. Heuring, J.D. Reist, and B.N. Billeck. 1999. Selected chemical analyses of water from lakes in Ellesmere Island National Park Reserve, Nunavut. Can. Data Rep. Fish. Aquat. Sci. 1050: iv + 7 p.

Selected chemical data collected between 1990 and 1998 from lakes in Ellesmere Island National Park Reserve, Nunavut are tabulated.

Key words: chemical elements; lakes survey; nutrients (mineral); trace elements; water analysis.

RÉSUMÉ

Babaluk, J.A., L.G. Heuring, J.D. Reist, and B.N. Billeck. 1999. Selected chemical analyses of water from lakes in Ellesmere Island National Park Reserve, Nunavut. Can. Data Rep. Fish. Aquat. Sci. 1050: iv + 7 p.

Le présent document présente les données sur certains produits chimiques, recueillies entre 1990 et 1998, dans les lacs de la réserve de parc national de l'Île-d'Ellesmere dans le Nunavut.

Mots-clés: éléments chimiques; levé des lacs; substances nutritives (minéraux); oligoéléments; analyse de l'eau.

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INTRODUCTION

The Canada Department of Fisheries and Oceans (DFO), in co-operation with the Department of Canadian Heritage, Parks Canada, has been conducting field research in Ellesmere Island National Park Reserve (EINPR), Nunavut (NT) since 1990. During May, 1990 a study on contaminants in Lake Hazen sediments was conducted (Muir et al. 1995). At this time, arctic char (*Salvelinus alpinus*) were also collected for a study on contaminants in muscle tissue (Muir and Lockhart 1992; Muir and Lockhart 1993). Intermittently between 1992 and 1998, DFO personnel conducted an assessment of the char within EINPR, in particular Lake Hazen char (e.g., population structure; genetic and morphological variation; life history types). Results of these studies have been reported by Brown Gladden et al. (1995), Reist et al. (1995), and Babaluk et al. (1997).

Opportunistically, while fish and sediment samples were collected, water samples for chemical analysis were also collected from several water bodies within EINPR. This report presents the chemical data from those water samples and adds to the existing information on EINPR water chemistry (Oliver and Corbett 1966; Gregor and Dahl 1990; Clark 1997).

MATERIALS AND METHODS

DESCRIPTION OF THE STUDY AREA

Ellesmere Island National Park Reserve (EINPR) is located at the northern end of Ellesmere Island, NT (Fig. 1, left inset). The most northern area of the Park Reserve, Cape Aldrich at 83°06'N is also the most northern point in the Canadian Arctic Archipelago. The Park Reserve, with an area of 37 775 km^2, is the second largest national park in Canada. Ellesmere Island National Park Reserve is described in detail in Parks Canada (1994).

There are relatively few lakes in EINPR and the most productive ones are located on the Hazen Plateau or along the coastal areas of the Grant Land Mountains (Fig. 1, right inset). Most of these lakes provide suitable habitat for some aquatic flora and invertebrates but are too shallow to support arctic char, the only freshwater fish species present in EINPR (Parks Canada 1994).

Our study was confined to lakes on the Hazen Plateau that either supported arctic char populations or were thought to (Fig. 1). This included Lake Hazen, the largest lake within EINPR and also the largest lake in the Canadian Arctic located completely north of the Arctic Circle. Lake Hazen has a surface area of ca. 540 km^2; a length of ca. 75 km and a maximum recorded depth of 263 m. The lake is further described in Johnson (1990) and Stewart (1994).

WATER SAMPLING AND ANALYSIS

Water samples were collected from the following lakes in Ellesmere Island National Park Reserve: Lake Hazen (81°50'N, 70°25'W), Kilbourne Lake (81°52'N, 68°25'W), Turnabout Lake (81°58'N, 68°34'W), unnamed lake, hereafter Lake A (82°06'N, 68°37'W), unnamed lake, hereafter Lake B (82°09'N, 68°29'W), Craig Lake (81°52'N, 68°47'W), Heintzelman Lake (81°42'N, 66°56'W), Alexandra Lake (81°46'N, 65°32'W), Lewis Lake (81°30'N, 74°35'W), Ekblaw Lake (81°40'N, 75°40'W), and Murray Lake (81°20'N, 69°34'W). A seawater sample was also collected from Chandler Fiord (81°33'N, 68°19'W). Collection dates for all locations and more precise sampling locations within Lake Hazen are shown in Fig. 1 and Tables 1, 2, and 3.

Water samples from all locations, except Craig, Lewis, Murray, and Ekblaw lakes and the 1998 Lake Hazen sample, were collected through the ice at a level ca. 1.5 m below the ice undersurface using a 1.5 L Kemmerer sampler. The water samples from Craig Lake were collected during the open-water season by hand-dipping the samples from shore. All other open-water samples were collected by hand-dipping the samples from a boat or helicopter pontoon. Two replicate samples from the same location (a and b) were collected from Craig Lake and one sample from each of two of three Murray Lake basins was collected (a and b) (see Fig. 1).

Water samples for dissolved element and nutrient analyses were analyzed at the Freshwater Institute Science Laboratory (FWISL) Analytical Water Chemistry Laboratory following

the procedures of Stainton et al. (1977). Estimates of precision for these procedures are also given in Stainton et al. (1977). Trace elements were analyzed at the FWISL Trace Element Laboratory by inductively coupled plasma-atomic emission spectrometry (ICP-AES) using commercial ICP standards and NRC standard reference materials (SLRS-1, SLRS-2). Detection limit was 0.1 $\mu g \cdot L^{-1}$.

DATA PRESENTATION

Chemical data for Lake Hazen area waters collected between 1990 and 1998 are presented in Tables 1, 2, and 3. In all tables, standard symbols are use to represent elements (Weast 1990). Other symbols and abbreviations used in Tables 1 and 2 are as follows: TDN = total dissolved nitrogen; TDP = total dissolved phosphorus; SRSi = soluble reactive silicon; TSS = total suspended solids; DIC = dissolved inorganic carbon; DOC = dissolved organic carbon; Cond. = conductivity; Alk. = alkalinity; and Org. acid = organic acid.

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Table 1. Chemical analyses of surface water samples from Lake Hazen, Ellesmere Island National Park Reserve, NT.

Location	Date	TDN	TDP	SRSi	Na	K	Mg	Ca	Cl	SO_4	TSS	DIC	DOC	Cond.	pH	Alk.	Org. acid
		$\mu g \cdot L^{-1}$		$mg \cdot L^{-1}$								$\mu m \cdot L^{-1}$		$\mu S \cdot cm^{-1}$		$\mu eq \cdot L^{-1}$	
Lake Hazen																	
mid-lake	14 May 1990	100	1	0.518	0.62	0.51	3.00	24.9	0.29	10.78	-	1550	180	155	8.40	1210	3
mid-lake	20 June 1992	-	-	-	-	-	-	21.9	-	-	-	-	-	-	-	-	-
Ruggles River	12 May 1995	120	2	0.536	0.63	0.47	3.00	25.8	0.21	11.09	-	1490	50	155	8.39	1416	30
Ruggles River	25 May 1996	60	2	0.528	0.65	0.57	3.00	26.0	6.77	2.17	1	1360	60	150	8.42	1324	56
Mesa Creek	27 May 1996	30	2	0.514	0.58	0.52	2.90	25.9	2.52	2.67	1	1310	50	147	8.40	1241	44
Henrietta Nesmith Glacier	13 May 1995	95	10	0.544	0.64	0.46	3.00	25.6	0.21	10.93	-	1510	60	156	8.39	1440	25
Henrietta Nesmith Glacier	26 May 1996	50	2	0.500	0.65	0.58	3.00	28.1	13.48	2.67	1	1370	60	153	8.42	1318	68
Hazen Camp	31 July 1998	260	1	0.442	0.48	0.43	2.30	20.1	0.36	9.94	11	1070	20	128	8.39	1051	-

Table 2. Chemical analyses of surface water samples from selected lakes from the Lake Hazen area, Ellesmere Island National Park Reserve, NT.

Location	Date	TDN	TDP	SRSi	Na	K	Mg	Ca	Cl	SO_4	TSS	DIC	DOC	Cond.	pH	Alk.	Org. acid
		$\mu g \cdot L^{-1}$		$mg \cdot L^{-1}$								$\mu m \cdot L^{-1}$		$\mu S \cdot cm^{-1}$		$\mu eq \cdot L^{-1}$	
Kilbourne Lake	27 May 1996	295	2	1.630	2.43	3.14	14.60	53.3	14.68	3.00	1	3250	250	343	8.73	3228	82
Turnabout Lake	27 May 1996	120	13	0.698	0.73	1.00	1.67	15.9	0.19	5.83	28	820	120	94	8.17	840	6
Lake A	22 May 1996	285	4	1.860	2.68	2.62	6.40	30.3	1.87	9.50	2	1870	450	197	8.53	1780	74
Lake B	22 May 1996	260	4	0.516	5.41	3.14	7.70	35.1	0.91	7.35	2	2400	400	237	8.63	2364	52
Craig Lake a	1 August 1997	120	4	1.060	3.94	2.21	14.70	40.1	-	-	<1	2250	180	338	8.63	2556	-
Craig Lake b	1 August 1997	120	2	1.050	3.94	2.20	14.70	40.1	-	-	<1	2280	170	336	8.64	2618	-
Heintzelman Lake	9 May 1995	170	8	1.170	8.04	1.56	11.50	47.5	13.12	27.20	-	2850	350	341	8.64	2756	42
Alexandra Lake	11 May 1995	200	3	0.528	1.16	0.39	5.00	31.5	2.17	4.45	-	2260	100	202	8.54	2112	8
Lewis Lake	27 July 1998	235	2	0.196	0.19	0.25	0.57	5.99	0.20	3.81	77	300	30	41	7.85	286	-
Ekblaw Lake	27 July 1998	110	1	0.331	1.63	0.57	3.55	7.35	0.33	32.19	1	120	30	94	7.24	81	-
Murray Lake a	26 July 1998	75	1	0.362	0.32	0.29	5.05	26.7	0.58	3.59	5	1760	50	176	8.54	1754	-
Murray Lake b	26 July 1998	205	1	0.375	0.30	0.29	4.60	27.0	0.54	2.75	2	1730	40	175	8.54	1721	-
Chandler Fiord (sea water)	16 June 1992	-	-	-	-	-	-	236.6	-	-	-	-	-	-	-	-	-

Table 3. Concentration of trace elements in surface water samples from selected lakes from the Lake Hazen area, Ellesmere Island National Park Reserve, NT.

Location	Date	Mn	Fe	Sr	Ba	Zn	Cu	Ni
		$\mu g \cdot L^{-1}$						
Lake Hazen								
mid-lake	20 June 1992	-	-	120	-	-	-	-
Ruggles River	12 May 1995	1.0	4	122	13	2.0	2.5	3
Ruggles River	25 May 1996	0.8	4	139	15	8.3	7.5	14
Henrietta Nesmith Glacier	13 May 1995	0.8	15	123	14	8.2	11.1	21
Henrietta Nesmith Glacier	26 May 1996	1.1	15	145	16	6.8	7.6	18
Mesa Creek	27 May 1996	0.8	8	140	13	4.8	5.5	14
Hazen Camp	31 July 1998	7.4	194	110	14	0.8	<0.5	5
Heintzelman Lake	9 May 1995	2.6	70	167	27	3.6	5.3	9
Alexandra Lake	11 May 1995	2.0	13	58	4	8.8	15.7	21
Kilbourne Lake	27 May 1996	1.5	11	245	35	5.7	4.4	4
Turnabout Lake	27 May 1996	13.2	1826	63	31	10.0	8.0	13
Lake A	22 May 1996	1.6	19	141	14	5.5	7.6	21
Lake B	22 May 1996	5.2	49	181	27	8.8	7.7	13
Craig Lake a	1 August 1997	<2.0	46	314	33	<0.5	0.9	<1
Craig Lake b	1 August 1997	<2.0	39	329	33	0.7	0.8	1
Lewis Lake	27 July 1998	21.5	1011	48	13	2.9	1.6	<2
Ekblaw Lake	27 July 1998	18.2	140	33	11	5.8	<0.5	9
Murray Lake a	26 July 1998	4.4	87	54	5	0.7	<0.5	<2
Murray Lake b	26 July 1998	3.1	37	53	<5	0.8	<0.5	<2
Chandler Fiord (sea water)	16 June 1992	-	-	4220	-	-	-	-

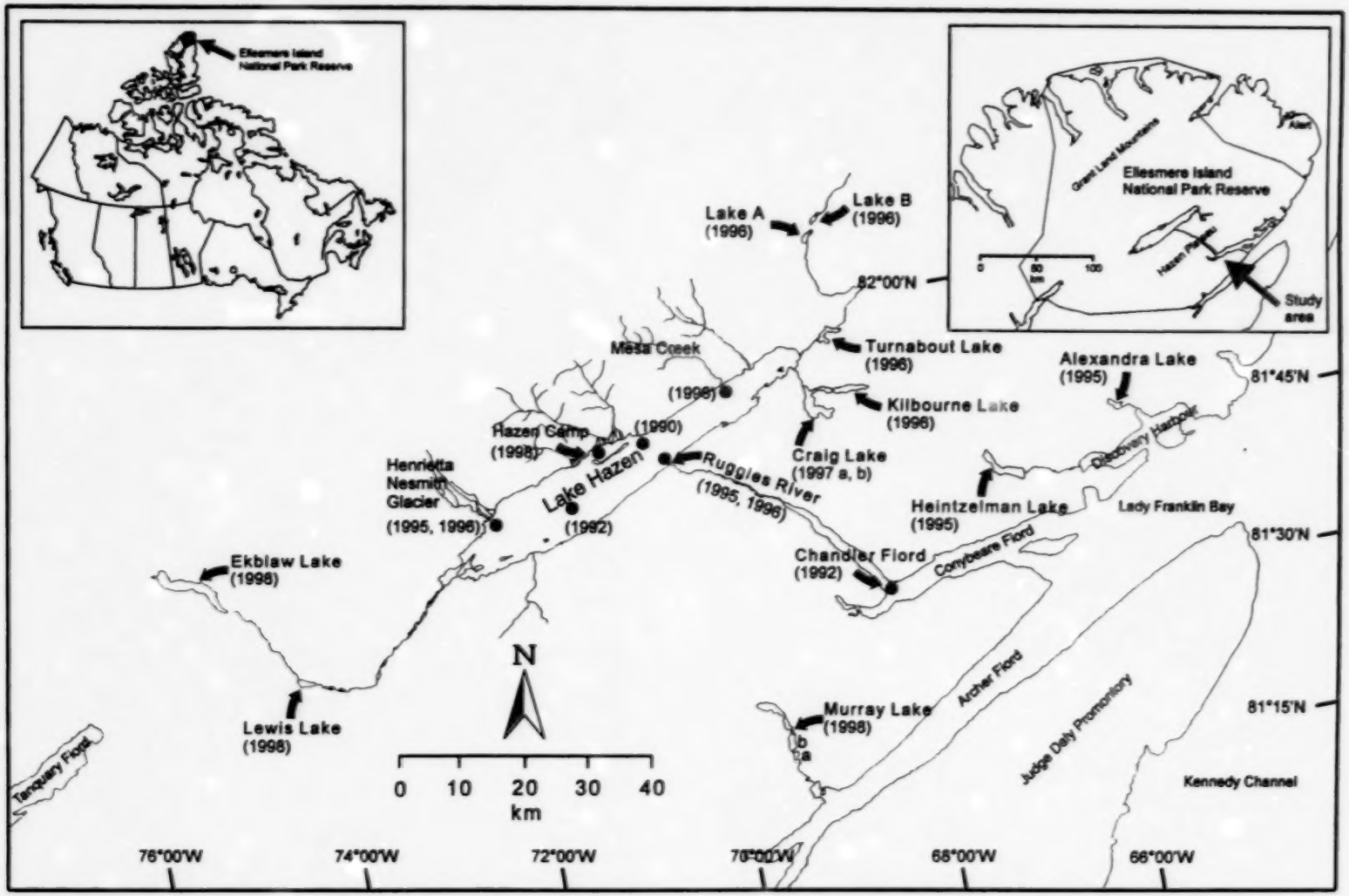

Fig. 1. Map of the Lake Hazen area, Ellesmere Island National Park Reserve, NT showing approximate locations of water sample collection sites (arrows/dots) and dates (year) samples were collected.